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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/812,467	03/30/2004	Sanjeev M. Naik	GP-303123	3141

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EXAMINER

NGUYEN, TU MINH

ART UNIT PAPER NUMBER

3748

DATE MAILED: 07/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/812,467

Applicant(s)

NAIK ET AL.

Examiner

Tu M. Nguyen

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 March 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 20040330,20060515.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

## DETAILED ACTION

### *Drawings*

1. The drawings are objected to because on the y-axis of Figure 6, "EQ" should read --A/F--, Correction is required.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, 4, 5, 10, 13, 18, 19, 21, and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Ito et al. (U.S. Patent 5,775,099).

Re claims 1 and 18, as shown in Figures 1, 7, 12, and 15-18, Ito et al. disclose an article of manufacture (30) comprising a storage medium (33) having a computer program encoded therein and a method for controlling a direct injection internal combustion engine (1) operable in a homogenous region of operation generally associated with relatively high engine load/high engine speed operating conditions and a non-homogeneous region of operation generally associated with relatively low engine load/low engine speed operating conditions (see Figure 7), the engine including a NOx trap (26) generally effective to accumulate NOx emissions during lean operation of the engine (see Figure 12A) and to release the accumulated NOx emissions during rich operation of the engine (see Figure 12B), the method comprising:

- providing a first region of homogeneous engine operation (when engine load is between L1 and L2) during periods of engine operation wherein the accumulated NO<sub>x</sub> emissions ( $\Sigma\text{NO}_x$ ) are below a first predetermined threshold (MAX) (when steps 100 and 101 have NO answer and when engine load is between L1 and L2, the engine is operated with a combined stratified and homogeneous lean air-fuel mixture in steps 102-103 as shown in Figure 7); and,

- providing a second region of homogeneous engine operation (when engine load is greater than L2) greater than the first region of homogeneous operation during periods of engine operation wherein the accumulated NO<sub>x</sub> emissions ( $\Sigma\text{NO}_x$ ) are not below the first predetermined threshold (MAX) (when steps 100 and 101 have YES answer, step 118 has NO answer, and when engine load is greater than L2, the engine is operated with a homogeneous rich air-fuel mixture in steps 119-120 as shown in Figure 15).

Re claims 2, 4, 19, and 21, the method and article of manufacture of Ito et al. further comprise a step of regenerating the NO<sub>x</sub> trap when the engine is operated in the second region of homogeneous operation (when engine load is between L2 and L0), wherein regenerating the NO<sub>x</sub> trap is caused to occur as a function of the accumulated NO<sub>x</sub> emissions in the NO<sub>x</sub> trap (when engine load is between L2 and L0, the engine air-fuel ratio is still lean and the NO<sub>x</sub> trap is regenerated only when an accumulated NO<sub>x</sub> emissions ( $\Sigma\text{NO}_x$ ) are above a first predetermined threshold (MAX)).

Re claims 10, as depicted in Figures 1, 15, 17, and 18, Ito et al. disclose a method for controlling regeneration of a lean NO<sub>x</sub> trap (26) comprising:

- estimating (in step 100) an accumulated NO<sub>x</sub> in a NO<sub>x</sub> trap located in the exhaust path of an engine; and,

- hastening regeneration of the NOx trap by reducing the size of a stratified charge operating region of the engine when the accumulated NOx exceeds a first threshold value and initiating regeneration when a full stratified charge operating region of the engine is exited (when steps 100 and 101 have YES answer, step 118 has NO answer, and when engine load is less than L1, the engine is switched from a normal full stratified air-fuel mixture to a combined stratified and homogeneous rich air-fuel mixture in steps 119-120 as shown in Figure 15).

Re claims 5, 13, and 22, the method and article of manufacture of Ito et al. further comprise a step of terminating regeneration and resetting (in step 114) the accumulated NOx to the level of the remaining stored NOx in the lean NOx trap when a regeneration ending event is reached (step 113 with YES answer).

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 6, 14, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. as applied to claims 5, 13, and 22, respectively, above, in view of Ishii et al. (U.S. Patent Application 2002/0029562).

The method and article of manufacture of Ito et al. disclose the invention as cited above, however, fail to disclose that the regeneration ending event is selected from the group consisting

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of rich deviation of gases flowing out of the NOx trap, expiration of a regeneration timer, and engine torque demand below a threshold value.

As shown in Figure 1, Ishii et al. disclose an engine exhaust purifying apparatus comprising a NOx trap (15) and a downstream air-fuel ratio sensor (25). As illustrated in Figure 6 and indicated in paragraph 0062, Ishii et al. teach that it is conventional in the art to terminate a regeneration event of the NOx trap when rich deviation of gases flowing out of the NOx trap is detected. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the sensor and teaching by Ishii et al. in the method and article of manufacture of Ito et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to timely regenerate a NOx trap.

6. Claims 3-9 and 20-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. as applied to claims 1 and 18, respectively, above, in view of Wachi et al. (U.S. Patent 6,763,657) and Ishii et al.

Re claims 3 and 20, the method and article of manufacture of Ito et al. further comprise a step of regenerating the NOx trap upon the first to occur of a) the accumulated NOx emissions exceeding the first predetermined threshold, and b) the engine being operated in the second region of homogeneous operation (when engine load is greater than L0 (lines 12-19 of column 11)).

Ito et al., however, fail to disclose that other conditions for the regeneration of the NOx trap to occur include a NOx trap temperature exceeding a threshold temperature, and the accumulated NOx emissions exceeds a second predetermined threshold greater than the first predetermined threshold.

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As shown in Figure 1, Wachi et al. disclose an engine having a NOx trap (6). As depicted in Figure 2, Wachi et al. teach that it is conventional in the art to initiate a regeneration step of the NOx trap (steps S09-S10) when a NOx trap temperature exceeding a threshold temperature (step S08 with YES answer) because the NOx trap begins to release NOx when its temperature is at or above the threshold temperature (lines 32-36 of column 2). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Wachi et al. in the method and article of manufacture of Ito et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to timely regenerate a NOx trap.

As shown in Figure 1, Ishii et al. disclose an engine exhaust purifying apparatus comprising a NOx trap (15). As depicted in Figure 11 and indicated in paragraph 0075, Ishii et al. teach that it is conventional in the art to force a regeneration step of the NOx trap when an accumulated NOx emissions exceeds a second predetermined threshold (TNOAMX) greater than a first predetermined threshold (TNOAP). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Ishii et al. in the method and article of manufacture of Ito et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to prevent inadvertent release of NOx emissions into the atmosphere.

Re claims 7 and 24, in the modified method and article of manufacture of Ito et al., regenerating the NOx trap is caused to occur as a function of the accumulated NOx emissions in the NOx trap (step 100 with YES answer).

Re claims 8 and 25, the modified method and article of manufacture of Ito et al. further comprise a step of terminating regeneration and resetting (in step 114) the accumulated NOx to the level of the remaining stored NOx in the lean NOx trap when a regeneration ending event is reached (step 113 with YES answer)..

Re claims 9 and 26, in the modified method and article of manufacture of Ito et al., the regeneration ending event is selected from the group consisting of rich deviation of gases flowing out of the NOx trap, expiration of a regeneration timer, and engine torque demand below a threshold value (in Ishii et al., as shown in Figure 6, a regeneration event is ended when a rich deviation of gases flowing out of the NOx trap is detected).

7. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. as applied to claim 10 above, in view of Wachi et al.

Re claim 11, the method of Ito et al. discloses the invention as cited above, however, fails to disclose that the method further comprises the steps of estimating the temperature of the NOx trap; and determining a desired air-fuel ratio for initiating regeneration of the NOx trap, the desired air-fuel ratio being determined based upon one or a combination of the estimated accumulated NOx stored within the NOx trap and the temperature of the NOx trap.

As shown in Figure 1, Wachi et al. disclose an engine having a NOx trap (6) and a temperature sensor (9) to estimate a temperature of the NOx trap. As depicted in Figures 2 and 3, Wachi et al. teach that it is conventional in the art to determine (in step S09) a desired air-fuel ratio for initiating regeneration of the NOx trap, wherein the desired air-fuel ratio being determined based upon one or a combination of the estimated accumulated NOx stored within the NOx trap and the temperature of the NOx trap (see Figure 3). It would have been obvious



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to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Wachi et al. in the method of Ito et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to increase a regeneration efficiency of the NOx trap.

Re claim 12, as taught by Wachi et al., the modified method of Ito et al. further comprises:

- determining whether (in step S08) the temperature of the NOx trap exceeds a threshold temperature (T1); and

- initiating regeneration of the NOx trap (steps S09-S10) when the estimated temperature of the NOx trap exceeds the threshold temperature (step S08 with YES answer) by forcing homogenous operation of the engine at the desired air-fuel ratio.

8. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. as applied to claim 13 above, in view of Gui et al. (U.S. Patent 6,722,121).

The method of Ito et al. discloses the invention as cited above, however, fails to disclose that the method further comprises a step of monitoring the elapsed regeneration event time, wherein the regeneration ending event is reached when the elapsed regeneration event time exceeds a target maximum regeneration event time interval.

As shown in Figure 1, Gui et al. disclose an engine exhaust purifying device comprising a NOx trap (35). As illustrated in Figure 2 and indicated on lines 2-4 of column 6, Gui et al. teach that it is conventional in the art to terminate a regeneration event of the NOx trap when an elapsed regeneration event time exceeds a target maximum regeneration event time interval. It would have been obvious to one having ordinary skill in the art at the time of the invention was

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made, to have utilized the teaching by Gui et al. in the method of Ito et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to timely regenerate a NOx trap.

9. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. as applied to claim 13 above, in view of official notice.

The method of Ito et al. discloses the invention as cited above, however, fails to disclose that the method further comprises a step of monitoring driver torque demand on the engine, wherein the regeneration ending event is reached when the driver torque demand drops below a threshold value, and wherein the regeneration ending event is triggered by a driver initiated action.

It is well known to those with ordinary skill in the art that a regeneration step of a NOx trap is initiated and maintained when a temperature of the NOx trap is above a threshold value where the release of NOx from the trap is possible. Such high temperature value is achieved only when an engine torque is high in response to a high engine load demand. So when a engine torque is low, a NOx trap temperature is decreased, which induces a controller to terminate the regeneration step of the NOx trap. Therefore, such disclosure by Ito et al. is notoriously well known in the art so as to be proper for official notice.

***Prior Art***

10. The IDS (PTO-1449) filed on March 30, 2004 and May 15, 2006 have been considered. An initialized copy of each is attached hereto.

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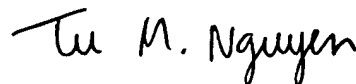
11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure and consists of four patents: Sasaki et al. (U.S. Patent 5,732,554), Tanaka et al. (U.S. Patent 6,336,320), Nishimura et al. (U.S. Patent 6,434,929), and Surnilla et al. (U.S. Patent 6,553,757) further disclose a state of the art.

*Communication*

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (571) 272-4862.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



TMN

July 21, 2006

Tu M. Nguyen

Primary Examiner

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